DOCUMENT RESUME

ED 186 475 TM 800 181

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TITLE Prediction of Reading Achievement for Learning Disabled Students Using the WISC-R.
PUB DATE Oct 79
NOTE 16p.; Paper presented at the Annual Meeting of the Northeastern Educational Research Association (10th, Ellenville, NY, October 24-26, 1979).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Achievement Tests; Cognitive Processes; *Elementary School Students; Grade 3; *Intelligence Tests; Memory; Multiple Regression Analysis; *Predictive Validity; Primary Education; *Reading Achievement; *Reading Difficulties; Reading Processes; Research Design; Word Recognition
IDENTIFIERS Wechsler Intelligence Scale for Children (Revised); Wide Range Achievement Test

ABSTRACT

This study examines the usefulness of the Wechsler Intelligence Scale for Children-Revised (WISC-R) in predicting the reading achievement of 74 disabled readers in grade 3 on the word recognition subtest of the Wide Range Achievement Test (WRAT). The WRAT word recognition subtest was used because previous research has demonstrated a high positive correlation between performance in reading isolated words and actual reading achievement in school. The results of three stepwise multiple regression analyses revealed that the Comprehension, Picture Completion, Similarities, Block Design, and Object Assembly subtests accounted for 36.92 percent of the variance associated with performance on the WRAT subtest. These findings are discussed relative to the identification of disabled readers with individual intelligence tests and their implications for future research in the differential diagnosis of reading disabilities. (Author/CTM)

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Prediction of Reading Achievement for Learning Disabled Students Using the WISC-R

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A paper presented at the Tenth Annual Convention of the Northeastern Educational Research Association, Ellenville, New York, October 24-26, 1979.

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Abstract

The WISC-R is one of the most widely used intelligence tests for the identification of children with reading disabilities. Research examining the usefulness of the WISC-R (and the WISC) in differentiating disabled readers from competent readers has been equivocal at best. Most of these studies have employed univariate statistical designs which attempt to delineate a characteristic subtest scatter profile which distinguishes between these two groups in a straightforward manner. Given the complexity of the reading process and the fact that the intent of norm-referenced tests is to maximize variance among individuals, it is possible that inferential statistical procedures used to determine the existence of a reading disability may not account for either of these factors.

This study examines the usefulness of the WISC-R in predicting the reading achievement of 74 disabled readers on the word recognition subtest of the WRAT. The WRAT word recognition subtest was used because previous research has demonstrated a high positive correlation between performance in reading isolated words and actual reading achievement in school. The results of three stepwise multiple regression analyses revealed that the Comprehension, Picture Completion, Similarities, Block Design, and Object Assembly subtests accounted for 36.92 percent of the variance associated with performance on the WRAT subtest. These findings are discussed relative to the identification of disabled readers with individual intelligence tests and their implications for future research in the differential diagnosis of reading disabilities.

Many attempts have been made to identify disabled readers on the basis of characteristic patterns of performance on the WISC and WISC-R (Bannatyne, 1974; Kaufman, 1976; Rugel, 1974). These studies have used three basic research designs. The first design yields a measure of intra-individual differences by comparing specific subtest scores to the mean total test performance. The purpose of this method is to identify those subtests which significantly deviate from the student's mean performance on the Full, Verbal, and Performance scales. It is assumed that scores significantly below the mean indicate specific deficits which characterize disabled readers. Although operational definitions of reading disability vary widely in these studies, and sampling flaws exist, it is usually difficult to obtain statistical significance of individual subtest deviations from the mean. Implications of significant differences, if found, are difficult to ascertain. Inter-subtest scatter of a moderate to high degree were found to be characteristic of non-disabled students (Kaufman, 1976). Kaufman (1976) found an average range of 7 scaled score points (sd = 2) for normal children aged 6½ to 11½. A subtest scaled score could deviate as much as 5 points from the mean and still be within normal limits.

The second design employs the contrasted groups model. One group is comprised of good readers, the other of disabled readers. The groups are usually matched for such variables as age, sex, general intelligence, and socio-economic status. By using t-tests, the two groups are analyzed for statistically significant differences on each of the WISC or WISC-R subtests. Several limitations are associated with this design. Skills measured by the subtests are not necessarily associated with reading ability. Modality-specific learning deficits (Webster, 1979a, 1979b) may account for between-

group differences. Also, since several t-tests are used, a significant difference due to chance alone is increased. Finally, factor analytic studies have found a great deal of common variance for most subtests (Cohen, 1959; Silverstein, 1976). Studies using the contrasted groups design have not consistently found evidence for differences according to subtest clusters.

The final research design utilizes the contrasted groups model without matching along demographic variables. The range of intelligence scores is restricted within each group. The limitations cited for the second design are also applicable to the third design. The results may be further confounded by external validity problems stemming from the uncontrolled variables.

The inconsistent findings of studies employing the above research design models may be due to the types of statistical analyses performed on the data. Inferences might be made relative to parameters of the larger population which may, or may not, be related to that population's performance. A unique WISC-R pattern could characterize disabled readers from good readers, but may not have predictive relationship to reading. The groups could differ along a dimension which is not related to reading. A more appropriate method for examining the relationship between intelligence and reading achievement might involve multiple regression procedures. The regression model could provide information about intellectual skills which are more directly related to the variable(s) of interest. The findings of the above studies are not related to current reading models and theories of reading disability except in a general way.

The purpose of the present research is to examine the predictive relationship between WISC-R performance by third grade reading disabled students and reading achievement as measured by the word recongition subtest

of the Wide Range Achievement Test (WRAT). This subtest was selected on the basis of earlier research indicating a high positive correlation between performance on the word recognition task (decoding isolated words) and actual reading grade level in school, especially at the primary grade level (Helfgott, 1976; Shankweiler & Liberman, 1972; Zifcak, 1976).

Method

Subjects

Seventy-four third grade students, 53 males and 21 females, were identified as learning disabled in the area of reading by special services personnel and classroom teachers. The word recognition subtest of the WRAT and eleven of the WISC-R subtests were administered by certified school psychologists according to the directions for administration provided by the publishers. Student ages ranged from 8 years, 9 months to 9 years, 8 months, with mean CA of 9.24 years (SD = 2.67). The mean Full Scale IQ (FSIQ) was 89.16 (SD = 14.30). The group WISC-R performance is summarized in Table 1. The mean grade equivalent of 3.64 (SD = 2.28) was found on the

Insert Table 1 About Here

WRAT word recognition subtest.

Statistical Analyses

The three IQ scores and the 11 subtests of the WISC-R were each correlated with the WRAT word recognition subtest using the Pearson product-moment correlation. Two separate multiple regression procedures were used to analyze the data. Predictor variables for the first regression procedure were VIQ and PIQ. This allowed examination of the relationship between

reading achievement and the WISC-R scales. The FSIQ was not used as a predictor because FSIQ is derived from the Verbal and Performance scales.

In the second stepwise multiple regression procedure the 11 WISC-R subtest scaled scores were used as predictor variables. The cut-off criteria used in determining variables for inclusion in the prediction equation were a minimum of 1.0% contribution to the accountable variance along with an accompanying decrease in the standard error of measurement.

Results and Discussion

In the first stepwise multiple regression analysis only VIQ entered into the equation using the established criteria. The two variables together accounted for 17.35% of the variance in reading achievement. The VIQ entered the equation on the first step accounting for 16.48% of the variance. Although the relationship between the two general scales of the WISC-R and reading achievement is low, the Verbal scale is much more predictive of reading achievement than the Performance scale.

From the second stepwise regression procedure it was found that five subtests collectively accounted for 36.92% of the variance in reading achievement (multiple R = .608). The five subtests in order of entry into the equation were: Comprehension, Picture Completion, Similarities, Block Design, and Object Assembly. Inclusion of Picture Arrangement, Vocabulary, and Coding subtests into the regression analysis accounted for 39.98% of the variation in reading achievement by increasing the multiple correlation to .632. Information, Digit Span, and Arithmetic failed to make a significant contribution to the prediction of reading achievement, either alone or in combination with each other.

Pearson product-moment correlations between the three IQ scales and the 11 WISC-R subtests with reading achievement ranged from -.002 for Object Assembly to +.521 for Comprehension. These correlations and percent of accountable variance associated with each subtest are summarized in Table 2.

Insert Table 2 About Here

The results of this study will be discussed from two perspectives. First, the results will be examined relative to previous research which utilized inferential statistical analyses. Secondly, the results will be exxamined in relation to their "goodness of fit" with a current reading model and theory of reading ability and disability.

Previous Research Findings

Inferential statistical analyses in previous research indicate that disabled readers perform most poorly on Information, Arithmetic, Digit Span and Coding, respectively. This rank ordering represents a mean ordering across 22 studies. There is a substantial variation in specific rank ordering by subtest difficulty among these studies. Using the stepwise multiple regression procedure, Information, Arithmetic, and Digit Span failed to enter the regression equation at any step. The Coding subtest entered the equation at the eighth step. The predictive relationship of these four subtests to reading achievement appears to be quite low.

Earlier research findings suggest primary attention and concentration deficits as characteristics of disabled readers. Also indicated is a possible secondary problem in verbally-oriented tasks. Lyle and Goyen (1969, p. 111) hypothesized that disabled readers performed poorly on Coding because of a "failure to use an effective labeling strategy as a memory aid,

resulting in increased time taken in checking the code key for each symbol." They also suggested that the "failure to use subvocal rehearsal as a strategy for keeping the items in mind," (Lyle & Goyen, 1969, p. 111) resulted in lower Arithmetic and Digit Span scores. Low scores on these three subtests have long been considered indicators of concentration problems and distractibility (Cohen, 1959; Dennerll, Broeder & Sokolov, 1964; Schafer, 1948).

A somewhat different picture of the reading disabled child, at the upper primary level, is presented by the multiple regression results. Three of the five most significant predictors of reading achievement (Picture Completion, Block Design, and Object Assembly) represent the global factor of Perceptual Organization. The other two subtests, Comprehension and Similarities, which are basically verbal tasks, appear to measure verbal expressive fluency, abstract and concrete verbal reasoning, the ability to retrieve information from long term memory (LTM) storage, and the generalization of knowledge from one situation to another (Gurvitz, 1951; Harrower, 1956; Wechsler, 1958). It appears that the reading disabled student is one who has difficulty with tasks requiring perceptual organization and a high degree of verbal reasoning and transfer of information. These characteristics must be compared to those processes presently associated with reading.

Information Processing[1] and Reading

During the reading process, it appears that the reader attends to certain essential physical characteristics of letters grouped into words in regard to a set of selective features of attributes. The reader begins

[1]The reader is referred to Cawley & Webster (in press) for a comprehensive review of current theories of the reading process.

by focusing on a point on the page for about one-quarter of a second. The eyes then sweep to the right for about 10 to 12 letter spaces to another pause and fixation. These quick eye movements are known as saccades. While fixating, the reader serially processes a pattern of physical features (lines, curves, angles, etc.) at the rate of one letter image every 10 to 20 milliseconds (Gough, 1976). This letter image is known as the iconic image. At the short-term memory (STM) level, the reader begins to analyze and integrate the iconic image in relation to specific linear and spatial orientations and other physical features. The reader can rapidly distinguish among letters and words by selectively attending to critical physical attributes of the visual image (Estes, 1972). By failing to recognize the critical features, the probability of incorrectly identifying each letter is greatly increased. This situation commonly occurs with such letters as b-d, p-g, and m-w. It seems that individual letters are analyzed and categorized into clusters prior to identification.

The three subtests comprising the Perceptual Organization factor are visually-oriented tasks requiring featural detection, analysis, and synthesis. The reader must also utilize information retrieved from LTM which is temporarily held in STM.

The Comprehension and Similarities subtests also mesh with the information-processing model of reading. Once the reader has analyzed the critical features, the visual image must be associated with the corresponding sounds (graphemic-phonemic match). The reader must then combine these individual sounds with other sounds in the word to form the total acoustic representation of the entire word (Liberman & Shankweiler, 1976). The individual must generalize and transfer information from one learning situation (letter-sound

correlation) to a second novel situation (decoding words). There is a heavy load placed on STM efficiency by these processes. The Comprehension and Similarities subtests require these abilities for successful performance.

Conclusions

In summary, the results of the present study suggest that disabled readers may have difficulty in featural detection and analysis of the critical physical elements which distinguish among visual objects, as based on WISC-R subtest pattern analysis. These readers also appear to have difficulty applying and generalizing verbal information to the decoding process. These implications are supported by a current model of information processing as it regards reading. Conclusions of previous research which analyzed subtest profiles of disabled readers are contradicted by the present findings and implications. It was suggested by these earlier studies that disabled readers had primary attentional and concentrational deficits in common. Future research analyzing intellectual characteristics of reading disabled students must replace traditional statistical procedures, which merely describe behavior, with multivariate procedures which are oriented toward the prediction of behavior. Furthermore, research findings should be related to current models of the reading process in order to generate a comprehensive, data-based model of the intellectual processes related to reading failure and success.

Table 1

Summary of WISC-R Performance

WISC-R Subtests	$\bar{X}$	sd
Information	7.33	2.52
Similarities	8.82	2.88
Arithmetic	7.82	3.07
Vocabulary	8.29	2.91
Comprehension	8.91	3.20
Digit Span	7.85	3.02
Picture Completion	9.44	3.04
Picture Arrangement	9.10	3.47
Block Design	8.26	3.26
Object Assembly	9.30	3.54
Coding	8.39	3.00
Verbal IQ (VIQ)	88.92	14.01
Performance IQ (PIQ)	91.51	15.29
Full Scale IQ (FSIQ)	89.16	14.30

Table 2

Product-Moment Correlations for the WISC-R Subtests and IQ Scales with WRAT Word Recognition

Subtests & Scales	Simple r	% of Variance Accounted
Information	.220	4.84
Similarities	.366	13.40
Arithmetic	.245	6.00
Vocabulary	.205	4.20
Comprehension	.521	27.14
Digit Span	.163	2.66
Picture Completion	.050	0.25
Picture Arrangement	.210	4.41
Block Design	.146	2.13
Object Assembly	-.002	0
Coding	.070	0.49
VIQ	.406	16.48
PIQ	.153	2.34
FSIQ	.346	11.97

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